

# DEPARTMENT OF CONSUMER & INDUSTRY SERVICES

## DIRECTOR'S OFFICE

### CONSTRUCTION SAFETY STANDARDS

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(By authority conferred on the director of the department of consumer and industry services by sections 19 and 21  
of Act No. 154 of the Public Acts of 1974, as amended, and Executive Reorganization Order No. 1996-2, being  
§§408.1019, 408.1021, and 445.2001 of the Michigan Compiled Laws)

R 408.42533 of the Michigan Administrative Code is amended as follows:

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## PART 25. CONCRETE CONSTRUCTION

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#### R 408.42501. Scope.

**Rule 2501.** This part pertains to all of the following:

- (a) The reinforcing, pouring, stressing, lifting, and floating of concrete.
- (b) The construction of forms and shoring used in connection with concrete construction.
- (c) Prestressed and poststressed operations.
- (d) Precast and tilt-up operations.

#### R 408.42516. Definitions; B to V.

**Rule 2516.** (1) "Bull float" means a tool used to spread out and smooth concrete.

(2) "Formwork" or "falsework" means the total system of support for freshly placed or partially cured concrete, including the mold or sheeting that contacts the concrete and all supporting members, hardware, and necessary bracing.

(3) "Foundation" or "footings" means a natural or built-up solid ground or base upon which shoring or reshoring is supported, including all underlying ground strata.

(4) "Guy" means a line that steadies a high object or structure by pulling against an off-center load.

(5) "Horizontal shoring beams" means beams or trusses used as load-carrying members in shoring systems.

(6) "Jacking operation" means the task of vertically lifting a slab or group of slabs from one location to another, such as from the casting location to a temporary (parked) location, from a temporary location to another temporary location, or to its final location in the structure

during the construction of a structure where the lift-slab process is being used.

(7) "Precast concrete" means a concrete member that is cast and cured at a location other than its final designated location.

(8) "Poststressed concrete" means a concrete member in which internal stresses have been introduced by the stressing of strands after the placement of concrete.

(9) "Prestressed concrete" means a concrete member in which internal stresses have been introduced by the stressing of strands before the placement of the concrete.

(10) "Qualified designer" means a person who, by possession of a degree, certificate, or professional standing, has demonstrated ability in design in the subject area being regulated.

(11) "Qualified person" means a person who, because of education or training, is knowledgeable about the erection methods, materials, and hazards of the work to be performed.

(12) "Reshore" means the vertical or inclined supporting members that are designed to distribute the weight of concrete and construction loads to lower levels until such loads can be supported by the concrete structure.

(13) "Shore" means a vertical or inclined support member that is designed to carry the weight of formwork, concrete, and construction live loads above.

(14) "Slip form" means a form that moves, usually continuously, during the placement of concrete. Movement may be either horizontal or vertical.

(15) "Vertical slip form" means a form that is jacked vertically and continuously during the placing of concrete.

**R 408.42517. Construction equipment and material requirements; adoption by reference.**

**Rule 2517.** (1) Equipment and material used in concrete construction and masonry work shall meet the applicable requirements prescribed in ANSI standard A10.9-1983, entitled "concrete construction and masonry work," which is adopted herein by reference and may be inspected at the Lansing office of the department of consumer and industry services. This standard may be purchased at a cost of \$6.00 from the American National Standards Institute, 1430 Broadway, New York, New York 10018, or from the Michigan Department of Consumer and Industry Services, 7150 Harris Drive, Box 30643, Lansing, Michigan 48909.

(2) The minimum safety factors of formwork accessories shall be as prescribed in table 1, as follows:

**Table 1**

**MINIMUM SAFETY FACTORS  
OF FORMWORK ACCESSORIES\***

<u>Accessory</u>	<u>Safety factor</u>	<u>Type of construction</u>
	1.5	Light formwork, 8 ft. or less in height with no hazard to life.
Form tie	2.0	All formwork over 8 ft. in height or hazardous to life. Formwork for architectural concrete.
	2.0	Formwork supporting form weight and concrete pressures only.
Form anchor	3.0	Formwork supporting weight of forms, concrete, construction live loads, and impact.
Form hangers	2.0	All applications.
Anchoring inserts used as form ties	2.0	Precast concrete panels when used as formwork.

\*Safety factors are based on ultimate strength of accessory.

**R 408.42518. Reinforcing steel.**

**Rule 2518.**(1) An employee who is placing and tying reinforced steel and who works from reinforcing steel more than 6 feet above an adjacent working surface shall be provided with an approved safety belt or equivalent device as prescribed in Part 45. Fall Protection, being R 408.44501 et seq. of the Michigan Administrative Code.

(2) A route designated as a means of access or egress across reinforcing steel for general traffic shall be provided with a walkway.

(3) An employee shall not be permitted to work above vertically protruding reinforcing steel unless the steel has been protected to eliminate the hazard of impalement of the employee.

(4) Reinforcing steel or walls, piers, columns, and other similar vertical structures shall be guyed, braced, or otherwise supported to prevent collapse.

(5) Reinforcing steel shall not be used as a scaffolding hook or stirrup or as a load-bearing member in a lifting device.

(6) Reinforcing steel shall not be welded and used as a load-bearing member.

(7) Roll wire mesh shall be secured at each end to prevent dangerous recoiling action.

(8) Roll wire mesh spear ends shall be trimmed to the nearest point.

**R 408.42519. Bulk concrete handling.**

**Rule 2519.** A bulk storage bin, container, or silo shall have a conical or tapered bottom with a mechanical or pneumatic means of starting the flow of the material.

**R 408.42520. Concrete mixing, pouring, and floating.**

**Rule 2520.** (1) A concrete mixer that is equipped with a 1-yard or larger loading skip shall be equipped with a mechanical device to clear the skip of material.

(2) A guardrail that is capable of withstanding a 200-pound side thrust shall be provided on each side of a skip on a mixer that has a capacity of 1 or more yards.

(3) The handle on a bull float that is used where it may contact an energized electrical conductor shall be constructed of nonconductive material or shall be insulated with a nonconductive sheath that has electrical and mechanical characteristics which provide the equivalent protection of a handle constructed of nonconductive material.

(4) A powered and rotating-type concrete troweling machine that is manually guided shall be equipped with a control switch that will automatically shut off the power when the hands of the operator are removed from the equipment handles or switch.

(5) The handles of a concrete buggy shall not extend horizontally beyond the wheels on either side of the buggy.

(6) A concrete bucket that is equipped with a hydraulically or pneumatically operated gate shall have a positive safety latch or a similar safety device installed to prevent premature or accidental dumping. The bucket shall be designed to prevent aggregate and loose material from accumulating on the top and sides of the bucket.

(7) An employee shall not be permitted to ride a bucket or walk or work under a bucket that is suspended from a crane or cableway.

(8) A concrete bucket that is positioned by a crane or cableway shall be suspended from an approved swivel safety-type hook.

(9) When the point of placement is not readily visible to the crane or cableway operator, a signalman shall be positioned in clear view of the operator and the point of placement. If positioning of a signalman in clear view is not possible, reliable telephone or radio communication shall be used.

(10) A pumpcrete or similar system using discharge pipe shall have pipe supports that are designed for a 100% overload. Compression air hoses in the system shall be provided with positive fail-safe joint connectors to prevent the separation of sections when pressurized.

(11) When discharging on a slope, a ready-mix truck's wheels shall be blocked and the brakes set to prevent movement.

(12) An employee who is green cutting, sandblasting, or applying concrete through a pneumatic hose shall wear head, face, and eye protection in compliance with the provisions of Part 6. Personal Protective Equipment, being R 408.40601 et seq. of the Michigan Administrative Code.

(13) A runway, ramp, or scaffold, as prescribed in Part 12. Scaffolds and Scaffold Platforms and rules 2143, 2150, and 2154 of Part 21. Guarding of Walking and Working Areas, and Part 45. Fall Protection, being R 408.41201 et seq.; R 408.42143, R 408.42150, and R 408.42154; and R 408.44501 et seq., respectively, of the Michigan Administrative Code, shall be provided for placement of concrete in areas such as walls, piers, columns, and beams.

(14) A concrete mixer shall be locked out when an employee is inside the mixer performing maintenance or repair to prevent injury due to the inadvertent operation of the equipment. An employee who is inside a concrete mixer performing maintenance or repair shall have the only key to the lock.

#### **R 408.42521. Forms and shoring generally.**

**Rule 2521.** (1) Formwork, shoring, and reshoring shall be designed, erected, supported, braced, and maintained so that they will support all vertical and lateral loads that may be imposed upon them during placement of concrete or until the loads can be supported by the concrete structure.

(2) Drawings or plans which are prepared by the qualified employee, except as required in R 408.42527(7) and R 408.42533(1), and which show the jack layout, formwork, shoring, working decks, and scaffolding shall be available at the jobsite.

(3) An employee who is working on formwork 6 feet or more above the ground or floor shall wear a safety belt and lanyard as prescribed in Part 45. Fall Protection, being R 408.44501 et seq. of the Michigan Administrative Code, or shall be provided with scaffolding as prescribed in Part 12. Scaffolds and Scaffold Platforms, being R 408.41201 et seq. of the Michigan Administrative Code.

(4) Stripped forms and shoring shall be removed and stockpiled promptly after stripping in all areas in which an employee is required to work or pass. Protruding nails, wire ties, and other form accessories that are not necessary to subsequent work shall be pulled or cut or other means shall be employed to eliminate a hazard.

(5) A construction load imposed on a structure, or a part thereof, shall not be more than the design capacity.

#### **R 408.42522. Placing and removing forms.**

**Rule 2522.** (1) A tag line shall be used to control large panels or large sections.

(2) Forms shall not be completely removed until the concrete can support its own weight and any currently superimposed load.

(3) Built-up sections shall have lifting attachments that are capable of handling an imposed load.

(4) Vertical, horizontal, and overhead forms that are being raised or removed by lifting equipment shall be braced or secured before being released from the load line.

(5) When using metal pan deck forms, the placement of the pans shall follow a sequence. Planks shall be laid in a manner that reduces the hazard of falling or else solid decking shall be used.

#### **R 408.42523. Vertical slip forms.**

**Rule 2523.** (1) Field operations for vertical slip forms shall be under the supervision of a qualified employee. The qualified employee shall be present on the deck during slipping operations.

(2) A lift shall proceed steadily and uniformly and shall not exceed the predetermined rate of lift.

(3) The steel rods or pipe on which the jacks climb or by which the forms are lifted shall be specifically designed for such climbing or lifting. Such rods shall be adequately braced if they are not encased in concrete.

(4) Jacks and vertical supports shall be positioned so that the vertical loads are distributed equally and do not exceed the capacity of the jacks.

(5) The jacks or other lifting devices shall be provided with mechanical dogs or other automatic holding devices to prevent slippage due to the failure of the power supply of the lifting mechanism.

(6) Vertical lift forms shall be provided with scaffolding or work platforms that completely encircle the area of placement. The scaffolds shall be as prescribed in Part 12. Scaffolds and Scaffold Platforms, being R 408.41201 et seq. of the Michigan Administrative Code.

(7) Lateral and diagonal bracing of vertical slip forms shall be provided to prevent excessive distortion of the structure during the jacking operation.

(8) During a jacking operation, the form structure shall be maintained in line and plumb.

#### **R 408.42524. Vertical shoring generally.**

**Rule 2524.** (1) When temporary storage of reinforcing rods, material, or equipment on top of formwork becomes necessary, these areas shall be strengthened to support the intended loads.

(2) The sills for shoring shall be sound, rigid, and capable of carrying the maximum intended load.

(3) When shoring from soil, the soil shall be capable of supporting the load and the soil shall be inspected after each occurrence which could affect its load-bearing capacity. Soil weakened from any occurrence that reduces its load-bearing capacity to less than that required to support a specific load shall be strengthened by compacting or other equivalent means.

(4) Vertical shoring shall be plumb and shall be braced to give it lateral stability during erection and at the time of concrete placement.

(5) Baseplates, shore heads, extension devices, and adjustment screws shall be in firm contact with the footing sill and the form.

(6) Eccentric loads on shore heads and similar members or shoring are prohibited, unless the shore heads are designed for the loading.

(7) Shoring equipment shall be inspected by a qualified employee before erection to determine that it is as specified in the shoring drawings or plans. Any equipment found to be damaged shall not be used for shoring.

(8) Before concrete is placed in the forms, all shoring equipment shall be inspected by a qualified employee to determine whether it was erected as specified in the shoring drawings or plans.

(9) Erected shoring shall be inspected by a qualified employee during and immediately after pouring concrete. Shoring that is found to be damaged or weakened shall be reinforced or reshored.

(10) Only designated employees shall be permitted on the first floor immediately under the forms during concrete placing work.

(11) Shoring equipment shall not be released or removed without the approval and assurance of a qualified employee that the remaining equipment will support the load.

(12) Construction or superimposed loads shall not be placed on an uncured concrete pour unless either of the following provisions is complied with:

(a) The strength of the concrete in the previous pour has been determined by testing to be capable of withstanding the load.

(b) A qualified person indicates that the concrete has developed sufficient strength to support the load. This subrule does not apply to slip form operations and slabs built at grade elevation.

(13) Vertical shoring shall not be loosened or removed until the concrete has attained 70% of the design strength or as specified by the engineer or architect.

(14) Construction or superimposed loads shall not be permitted on any area where vertical forms have been loosened or removed before the concrete has attained 100% of the design strength.

(15) Reshoring shall be provided, when necessary, to support slabs and beams after stripping or where

the members are subjected to superimposed loads due to the construction work done.

(16) Vertical shoring shall not be adjusted to raise formwork after concrete is in place, unless specifically provided for in the design specifications.

**R 408.42525. Metal frame shoring.**

**Rule 2525.** (1) Metal frames used for shoring shall not be loaded beyond the rated capacity.

(2) Locking devices on frames and braces shall be in good working order; coupling pins shall align the frame or panel legs; pivoted cross braces shall have their center pivot in place, and all components shall be without defects.

(3) The devices for attaching the external lateral stability bracing shall be securely fastened to the legs of the shoring frames.

**R 408.42526. Tube and coupler shoring.**

**Rule 2526.** (1) The couplers or clamps shall not be used if they are deformed, broken, have defective or missing threads on bolts, or have other defects.

(2) The interlocking of the tubular members and the tightness of the couplers shall be checked before pouring concrete.

(3) Couplers shall be made of drop-forge steel, malleable iron, or structural grade aluminum.

**R 408.42527. Single-post shores.**

**Rule 2527.** (1) For stability, a single-post shore shall be horizontally braced in both the longitudinal and transverse directions, and diagonal bracing shall also be installed. The bracing shall be installed as the shores are being erected.

(2) The top of single-post shores shall be restricted from movement by the use of retainers or other equivalent means.

(3) Devices for attaching the external lateral stability bracing shall be securely fastened to the single-post shores.

(4) Timber and fabricated single-post shores and the adjusting devices shall be inspected before erection. Timber for single-post shores shall not be used if it contains splits, cuts, rotting, or structural damage.

(5) A metal single-post shore and the adjusting devices shall not be used if the shore or devices are heavily rusted, bent, dented, or rewelded or have broken weldments or other defects.

(6) A nail that is used to secure bracing on adjustable timber single-post shores shall be driven home and the point bent over, if possible.

(7) A single-post shore that is used in more than 1 tier shall be designed by a registered engineer and inspected by a qualified employee.

(8) When formwork is at an angle or is sloping or when the surface shored is sloping, the shoring shall be designed for this loading by a qualified engineer.

**R 408.42528. Flying forms.**

**Rule 2528.** (1) A qualified employee shall inspect the formwork for flying forms before any movement to insure that all components are properly placed and adjusted.

(2) Allowable impact loads for flying forms shall not be exceeded during the rollout operation.

(3) A safety line shall be attached to the form during the rollout and flying operation.

(4) Nothing shall be allowed on the forms during movement unless it is securely fastened to the forms.

(5) No one, other than the rigger, shall be permitted on top of the deck form after rollout operations have been completed.

(6) Rigging of the deck form shall be completed before the line from the crane takes the total load of the form.

**R 408.42531. Prestressed and poststressed concrete operations.**

**Rule 2531.** (1) An expendable strand deflection device that is used to pretension concrete members shall have a designed safety factor of not less than 2. A reusable device shall have a safety factor of not less than 3.

(2) Expendable and reusable strand deflection devices shall not be loaded in excess of their maximum intended load.

(3) An employer shall designate a qualified employee to inspect all jacking and pulling equipment before each use and during use.

(4) Defective equipment shall be repaired or replaced before continued use.

(5) Tensioning strands that have kinks, bends, nicks, and other defects shall not be used.

(6) Welding or cutting is prohibited near strand that has been unrolled, strung, or tensioned or at any other location where strand is stored.

(7) During jacking operations of any tensioning element or group of tensioning elements, the anchor shall be kept turned up close to the anchor plate.

(8) An employee shall not stand in the line of, in back of, or over the jacking equipment during tensioning operations.

(9) Only an employee who is operating tensioning equipment shall be permitted in the immediate vicinity when tensioning is in progress.

(10) Stress members shall be lifted with the lifting devices at points specifically designed. An employee shall not be under stressed members during lifting and erection.

(11) Audible or visual signaling devices shall be operated to warn employees when tensioning operations are under way.

(12) All employees who are not directly involved in the tensioning operations shall be cleared from the area and shall remain clear until tensioning operations are completed and the signaling devices are turned off.

**R 408.42532. Precast and tilt-up operations.**

**Rule 2532.** (1) A lifting attachment for precast and tilt-up operations shall have a designed safety factor of not less than 5. Reinforcing steel shall not be used as a lifting attachment. Lifting hardware shall be capable of supporting 5 times the maximum intended load applied or transmitted to the lifting hardware.

(2) Precast members shall be handled in accordance with the shop or erection drawings.

(3) Precast concrete wall units and vertical panels shall be braced to prevent collapse. A permanent connection may be used in place of bracing if it is capable of withstanding all loads imposed during construction.

(4) An employee, except for a connector, shall not be permitted under a precast section, wall, or panel during lifting and tilting operations.

**R 408.42533. Lift-slab operations.**

**Rule 2533.** (1) A registered professional engineer who is qualified in lift-slab operations shall design and plan lift-slab operations. An employer shall implement the plans and designs and shall include detailed instructions and sketches that indicate the prescribed method of erection. The plans and designs shall also include provisions for ensuring lateral stability of the building or structure during construction.

(2) An employer shall ensure that jacks are marked to indicate the rated capacity established by the manufacturer.

(3) An employer shall ensure that jacks are not loaded beyond the rated capacity established by the manufacturer.

(4) An employer shall ensure that jacking equipment is not overloaded and the threaded rods and other members that transmit loads to the jacks are capable of supporting not less than 2 1/2 times the load to be applied. Jacking equipment shall include all of the following:

- (a) Jacks and other lifting units.
- (b) Lifting angles.
- (c) Lifting nuts.
- (d) Hook-up collars.
- (e) T-caps.
- (f) Shearheads.
- (g) Columns and footings.

(5) An employer shall ensure that a jack is designed and installed so that it will not lift or continue to lift when it is loaded in excess of its rated capacity.

(6) An employer shall ensure that a jack has a safety device installed that will cause the jack to support the load in any position if the jack malfunctions or loses its lifting ability.

(7) An employer shall ensure that jacking operations are synchronized to ensure even and uniform lifting of the slab. An employer shall ensure, that during lifting, all points of the slab support are kept within 1/2 of an inch of that needed to maintain the slab in a level position.

(8) If leveling is automatically controlled, then an employer shall ensure that a device is installed which will stop the operation when the 1/2-inch tolerance specified in subrule (7) of this rule is exceeded or when there is a malfunction in the jacking system.

(9) An employer shall ensure that the maximum number of manually controlled jacks on 1 slab is limited to a number, which shall not be more than 14, that will permit the operator to maintain the slab level within specified tolerances. The controls shall be located near a qualified person.

(10) An employer shall ensure that an employee, except for an employee who is essential to the jacking operation, is not permitted in the building while any jacking operation is taking place. For the purpose of this subrule, a jacking operation begins when a slab or group of slabs is lifted and ends when the slabs are secured with either temporary connections or permanent connections.

(11) An employer shall ensure that an employee is not permitted under a slab during jacking operations.

(12) An employer shall ensure that all welding on temporary and permanent connections is performed in accordance with the requirements of the American national standards institute and American welding

society standards ANSI/AWS D1.1-86 entitled "Structural Welding Code - Steel," and ANSI/AWS B1.10-86 entitled "Guide for the Nondestructive Inspection of Welds. These standards are adopted by reference in these rules and are available for purchase, at a cost as of the time of adoption of these rules of \$50.00 and \$12.00 respectively, from the American National Standards Institute, 11 West 42nd Street, New York, New York 10036, the American Welding Society, 550 N.W. Le Jeune Road, P.O. Box 351040 Miami, FL 33125, and from the Standards Division, Michigan Department of Consumer and Industry Services, Box 30643, Lansing, Michigan 48909. An employer shall ensure that the welders are familiar with the welding requirements specified in the lift-slab plan and specifications.

(13) An employer shall ensure that load transfer from jacks to building columns is not executed until the welds on the column shear plates are cooled to air temperature.

(14) An employer shall ensure that jack-lifting units are positively secured to building columns so that they do not become dislodged or dislocated.

(15) An employer shall ensure that equipment is designed and installed so that the lifting rods cannot slip out of position or the employer shall initiate other measures, such as the use of locking or blocking devices, that will provide attachments and prevent components from disengaging during lifting operations.

#### **R 408.42534. Concrete paving machines; warning devices.**

**Rule 2534.** A concrete paving machine that has a power reverse shall be equipped with an automatic audible warning device which operates when the paver is backing up.

#### **R 408.42535. Concrete curing.**

**Rule 2535.** (1) When construction areas are enclosed with canvas or other flammable materials, open flame salamanders shall not be used as a source of heat.

(2) When salamanders or similar heating units are used to protect concrete from freezing, all of the following requirements shall be complied with:

- (a) All salamanders shall be covered and properly vented.
- (b) Salamanders shall not be refueled until extinguished and permitted to cool.
- (c) Where tarpaulins or other flammable materials are used to form protective enclosures for winter protection, the material shall be fire resistant and installed to prevent contact with the heating unit.